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Claims

[c1] A sintering system comprising:
a tool chamber enclosing a sinter material;
a laser system sintering said sinter material as a function of controller signals; and
a controller generating said controller signals as a function of a predetermined tool design, said predetermined tool design comprising a first section of said tool comprising a joint component for coupling said first section to at least one other section of said tool.

[c2] The system of claim 1, wherein said predetermined tool design further comprises a second section of said tool, sintered separately from said first section, receiving said joint component of said first section in a second section receiving area.

[c3] The system of claim 2, wherein said predetermined tool design further comprises a plurality of joint components and receiving areas distributed on both said first section and said second section for coupling together sections of said tool.

[c4] The system of claim 3, wherein said first section and said

second section define holes aligned during an assembly process of said tool, wherein said first section and said second section holes receive at least one bolt bolting said first section to said second section.

[c5] The system of claim 1, wherein said predetermined tool design further comprises a plurality of sections of said tool, sintered separately from said first section, at least one of said plurality of sections receiving said joint component of said first section in a receiving area, said plurality of sections fitting together in a predetermined manner.

[c6] The system of claim 1, wherein said joint component comprises a tongue feature or a tongue feature comprising a cross pin for aligning said tongue feature with a second section receiving area.

[c7] The system of claim 1 further comprising a first heat sink positioned within said tool chamber for cooling said joint component or a second predetermined feature of said tool, thereby limiting warping of said joint component or said predetermined feature during sintering of said tool.

[c8] The system of claim 1, wherein said predetermined tool design comprises a buffer feature protecting said joint

component or a second predetermined feature of said tool such that said buffer feature is primarily affected by heat generated during sintering in an area of said joint component or a second predetermined feature of said tool.

[c9] The system of claim 1, wherein individual contoured details of said tool are sintered or manufactured during separate operations as said tool and later coupled to said tool at predefined locations on said tool.

[c10] The system of claim 1 further comprising a plurality of predetermined features comprising said joint component, wherein all of said plurality of predetermined features are designed on one side of said tool.

[c11] A method for laser sintering a tool within a part chamber comprising:

predetermining a number of required sections for the tool;

predetermining locations of joint features on said number of sections for connecting said number of sections thereby constructing the tool following sinter operations; and

laser sintering a sinter material to form each of said number of sections of the tool individually.

[c12] The method of claim 11 further comprising predetermining orientations of said number of sections within the part chamber as a function of minimizing warping said joint features or other tool features during sintering.

[c13] The method of claim 11 further comprising activating a heat sink within the part chamber for limiting warping of said joint features.

[c14] The method of claim 11 further comprising activating a plurality of heat sinks at predetermined times within the part chamber for limiting warping of tool features comprising said joint features.

[c15] The method of claim 14 further comprising predetermining an orientation of each of said number of sections of the tool within the part chamber as functions of minimizing warping of said tool features such that all of said tool features are on one side of each section of the tool.

[c16] The method of claim 11 further comprising predetermining a location of a buffer feature in a close proximity to at least one of said joint features; and removing said buffer feature from the tool following sintering of at least one of said number of sections.

[c17] The method of claim 11 further comprising predetermining positions on at least one of said number of sections

for at least one of a step and thickness variation, a gusset, a stiffener, an interface and coordination feature for making interfaces, a construction ball interface, a coordination hole, a trim of pocket and drill insert, a hole pattern, or a hole for interfacing hardware.

[c18] A sintering system comprising:
a part cylinder enclosing a sinter powder;
a first heat sink arrangement positioned within said tool chamber for cooling at least one of a first plurality of predetermined features of a tool on a first tool section, thereby limiting warping of said at least one of said first plurality of predetermined features during sintering of said first tool section;
a second heat sink arrangement positioned within said tool chamber for cooling at least one of a second plurality of predetermined features of a tool on a second tool section, thereby limiting warping of said at least one of said second plurality of predetermined features during sintering of said second tool section, said second tool section adapted to couple to said first tool section;
a laser system sintering said first tool section and said second tool section as a function of controller signals; and
a controller generating said controller signals as a function of a predetermined tool design, predetermined po-

sitions of said first plurality of tool features and said second plurality of tool features, and a predetermined orientation of said first section and said second section within said part chamber as a function of minimize warping said tool features during sintering, wherein said predetermined tool design comprises a buffer feature protecting at least one of said first plurality of predetermined features or said second plurality of predetermined features such that said buffer feature is primarily affected by heat generated during sintering in an area of said at least one of said first or second pluralities of predetermined features, wherein said first or second pluralities of predetermined features is designed on one side of said tool.

[c19] The system of claim 18, wherein said first or second pluralities of predetermined features comprise at least one of a step and thickness variation, a gusset, a stiffener, an interface and coordination feature for making interfaces, a construction ball interface, a coordination hole, a trim of pocket and drill insert, a hole pattern, or a hole for interfacing hardware.

[c20] The system of claim 18, wherein said buffer feature is removable such that damage is limited to said predetermined feature when said buffer feature is removed due to a weak connective link between said buffer feature

and said predetermined feature.

[c21] The system of claim 18, wherein individual contoured details of said tool are sintered or manufactured during separate operations as said tool and later coupled to said tool.

[c22] The system of claim 18, wherein said controller generates said controller signals as a function of said predetermined tool design through activating said first heat sink arrangement or said second heat sink arrangement depending on which tool section is required.

[c23] A method for constructing a tool with a sintering system having a part chamber comprising:
predetermining a position for a first joint feature on a first section of the tool;
predetermining an orientation of said first section of the tool within the part chamber as a function of minimizing warping of said joint feature during sintering;
activating a heat sink within a part chamber for limiting warping of said first joint feature;
laser sintering said first section of the tool within said part chamber;
predetermining a position for a receive feature on a second section of the tool;
laser sintering said second section of the tool; and

coupling said first section to said second section through receiving said joint feature in said receive feature.

[c24] The method of claim 23, wherein coupling said first section to said second section further comprises bolting said joint feature to said receive feature.

[c25] The method of claim 23 further comprising predetermining positions of a plurality of tool features on said first section of the tool.

[c26] The method of claim 25, wherein predetermining positions of a plurality of tool features on said first section of the tool further comprises orienting the tool such that all of said tool features are on one side of the tool.

[c27] The method of claim 23 further comprising predetermining positions of a plurality of tool features on said second section of the tool.

[c28] The method of claim 23 further comprising predetermining a plurality of sections of the tool comprising said first section and said second section; sintering each of said plurality of sections of the tool separately; and coupling all of said plurality of sections of the tool together.

[c29] A tool system comprising:
a first section manufactured through a first sintering

process comprising at least two mating edges, each of said edges comprising a joint feature;

a second section manufactured through a second sintering process said second section comprising at least two mating edges, each of said edges comprising a joint feature, at least one of said second section joint features designed for coupling to at least one of said first section joint features;

a third section manufactured through a third sintering process said third section comprising at least two mating edges, each of said edges comprising a joint feature, at least one of said third section joint features designed for coupling to at least one of said second section joint features; and

a fourth section manufactured through a fourth sintering process said fourth section comprising at least two mating edges, each of said edges comprising a joint feature, at least one of said third section joint features designed for coupling to at least one of said first section joint features or said third section joint features.

[c30] The tool system of claim 29, wherein said first section joint features, said second section joint features, said third section joint features, and said fourth section joint features comprise at least one of a tapered tongue or a groove for receiving said tapered tongue.

[c31] The tool system of claim 29, wherein at least one of said first section, said second section, said third section, or said fourth section further comprise, sintered thereon, at least one of a step and thickness variation, a gusset, a stiffener, an interface and coordination feature for making interfaces, a construction ball interface, a coordination hole, a trim of pocket and drill insert, a hole pattern, or a hole for interfacing hardware.

[c32] The tool system of claim 29 further comprising a plurality of additional tool sections coupled together during construction of said tool.

[c33] The system of claim 29, wherein at least one contoured detail is sintered separately from said first section and said second section and is coupled to at least one of said first section or said second section.

[c34] A method for sintering a tool comprising:
sintering a first plurality of predetermined tool features in a first tool section;
predetermining an orientation of said first tool section within a part chamber as a function of minimizing warping said first plurality of tool features during sintering;
cooling at least one of said first plurality of predetermined tool features during sintering of said first tool

section;

sintering an interchangeable contour detail;

coupling said contour detail to said first tool section;

sintering a second plurality of predetermined tool features in a second tool section;

sintering a third plurality of predetermined tool features in a third tool section;

sintering a fourth plurality of predetermined tool features in a fourth tool section; and

coupling said first, second, third, and fourth sections together.

[c35] The method of claim 34, wherein coupling said contour detail further comprises coupling said contour detail to said first section through either a sintered bolt or a standard bolt or bolting system.

[c36] The method of claim 34 further comprising predetermining a location of a buffer feature for at least one of said first plurality of predetermined tool features; and removing said buffer feature from the tool following sintering of the tool.

[c37] The method of claim 34 further comprising orienting said first section such that all of said plurality of tool features are on one side of the tool.

[c38] The method of claim 34 further comprising sintering a plurality of contour details; and coupling said plurality of contour details to both said first section and said second section.

[c39] The method of claim 34 further comprising sintering a plurality of tool sections; and coupling said plurality of tool sections to at least one of said first section, said second section, said third section, or said fourth section.

[c40] The method of claim 39, wherein sintering said plurality of tool sections further comprises predetermining an orientation for each of said plurality of tool sections as a function of limiting warping of features of said plurality of tool sections.